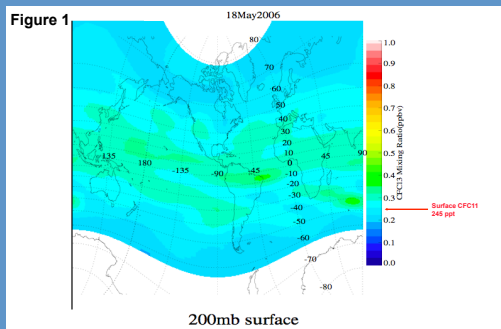


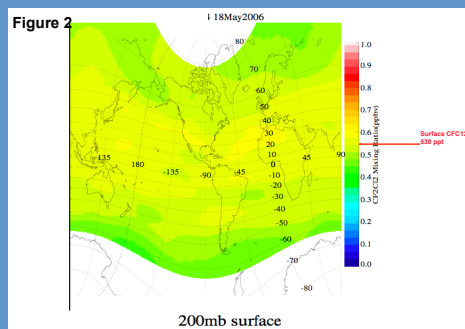
Comparison of HIRDLS CFC11 and CFC12 with ground-based observations by the Network for the Detection of Atmospheric Composition Change (NDACC)

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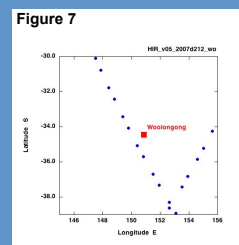
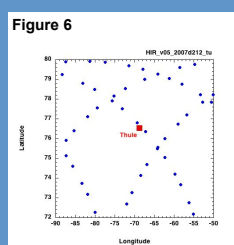
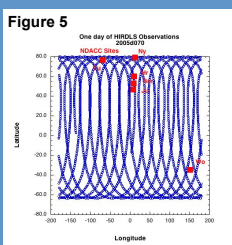
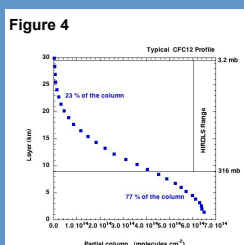
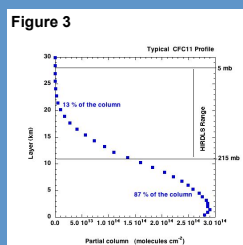
The CFC11 and CFC12 measurements by HIRDLS, unique among the Aura measurements, are compared with observations from ground-based NDACC Fourier transform spectrometers. Figures 1 and 2 show the HIRDLS observation of the global distribution of CFC11 and CFC12 at 200 mb. Overlap of the measurement ranges of the two techniques is not optimal. HIRDLS measures the vertical profile of the volume mixing ratio from 5.1 mb to 215.4 mb for CFC11 and from 3.2 mb to 316.2 mb for CFC12. Figure 3 shows a typical vertical profile of partial column of CFC11 and Figure 4 shows CFC12 from the surface to 30 km. As may be seen in Figures 3 and 4 HIRDLS observations cover less than a quarter of the total column of CFC11 or CFC12 (13 % for CFC11 and 23% for CFC12).



Figures 1 and 2. Global distributions of CFC11 and CFC12 at 200mb. HIRDLS observation of the CFC mixing ratio at 200 mb (about 12 km) for a single day in 2006. The latitude coverage of HIRDLS is approximately 65 S to 80 N. The surface value of CFC11 and CFC12 for 2006 from a number of NOAA observing sites also is indicated on the figures.

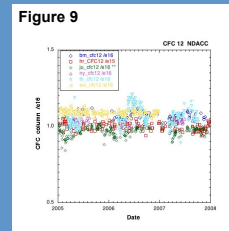
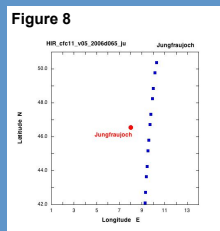


Not all of the NDACC surface sites measure CFC11 and CFC12. Only Thule, Ny Alesund, Bremen, Harastua, Jungfraujoch and Wollongong have included results for CFC11 or CFC12 in their archived submissions. The locations of these sites are shown in Figure 5. Also the density of HIRDLS observations at the various locations is very different as may be seen in Figures 6, 7 and 8 below that illustrate a 1000 km box centered on an individual NDACC site. Figure 9 shows the total column of CFC12 from 2005 to 2008 for all of the NDACC sites reporting CFC12. As may be seen in Figure 9 results from the sites are very similar (results from the high altitude site at Jungfraujoch have been scaled to account for its altitude). Subsequent comparisons will be done between the partial columns observed by HIRDLS and Thule results.

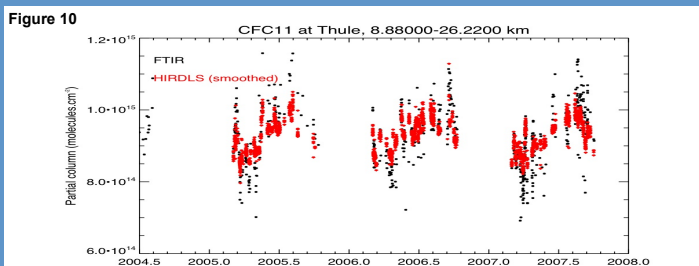


Coincident measurements of the partial column vertical profile from HIRDLS and the NDACC sites may be compared. However, ground-based, remote NDACC observations of the vertical profile are largely influenced by the adopted a priori profile. Limited information is available in the NDACC observation to constrain the vertical profile.

A better comparison of the two techniques may be obtained by comparing the partial column covered by the HIRDLS observation with the partial column derived from NDACC observations rather than comparing vertical profiles, that is comparing all the CFC12 between 9 and 30 km from both techniques.



Figures 10 and 11 Partial columns of CFC11 and CFC12 between 8.8 and 26.2 km from HIRDLS measurements convolved with the ground-based Thule averaging kernel (shown in red) and partial columns for the same altitude range from the ground-based infrared observations (shown in black). HIRDLS observations are contained in a box around the Thule, Greenland site (72-81N, 48.4-88.0W). The time difference between the satellite and ground observations is +/- 6 hours. HIRDLS observations are included for the lifetime of the experiment from 2005 through 2007.



Differences between the partial columns from the two techniques calculated as $(\text{HIRDLS} - \text{FTIR}) / 0.5 (\text{HIRDLS} + \text{FTIR}) \times 100$: for CFC11 mean difference of 1.20% with a standard deviation of 6.28%; for CFC12 a mean difference of -6.83 % with a standard deviation of 3.66%. These differences are within the uncertainties of the two techniques.

